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Eelgrass Distribution in the Great Bay Estuary and Piscataqua River for 2016

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Report submitted to the
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Table of Contents

Abstract

Eelgrass distribution in Great Bay, Little Bay, and the Piscataqua River Estuary were mapped from aerial photography acquired on August 5, 2016. The total area of eelgrass beds with 10% or greater cover and a polygon area equal to or greater than 100 square meters was 683.42 hectares or 1688.71 acres. Eelgrass polygons were coded for Assessment Zone location and the results reported in Table 1.The largest concentration of eelgrass was found in Great Bay with lesser amounts in the vicinity of Portsmouth Harbor. The total area of eelgrass was nearly identical to that mapped in 2013 though there were variations in distribution.

Introduction

The report that follows provides details of the mapping of eelgrass distribution in Great Bay and the Piscataqua River for the year 2016. Aerial photography was obtained in August, 2016 and was followed closely by field work in the September through October time period to establish signatures for photointerpretation and to aid in the accurate mapping of eelgrass distribution. At the time of this report, the mapping described here is the latest regional documentation of the status of eelgrass beds in the area. The project area is described and illustrated in the Appendix, A1.

Methods

Mapping of the distribution of eelgrass was based on photointerpretation of aerial photography obtained on August 5, 2016, under a contract with Kappa Mapping, Bangor, Maine. Preliminary, georeferenced images were made available in early September, 2016, and were used for field logistics. This initial photography did not have the locational accuracy of the final photomosaic and had not been color balanced but provided sufficient detail to locate features of interest and select stations to be visited. Stations were selected in Great Bay, Little Bay, and the Piscataqua River and field visits on September 8 provided information on presence/absence, cover, and nature of the edge of eelgrass beds. Since there was a variety of photographic signatures, field stations were important for the understanding of the nature of the signatures. Additional field visits for this project took place on October 4,13,14, and 24.

The boat and at least one assistant were provided by PREP for field verification. Location of observations was recorded using high accuracy Trimble GeoXH or GeoXH GPS and a

Garmin Colorado 400c.

A total of 130 stations were visited and observations were made with a Seaviewer drop camera and a surface monitor at most of these stations. In a few cases, the bottom could be clearly viewed without the use of the drop camera. Recordings were made at most but not all stations. In most cases, observations were made and videos recorded as the boat either drifted or motored at low speed over the station and one or more observations were recorded on a field sheet (Appendix A.2). Observations included the presence of eelgrass, whether eelgrass cover was equal to or greater than 10 %, where possible the presence and type of macroalgae, and substrate. The time of the observation was recorded and used in conjunction with the time of GPS observations which were recorded as points in a GPS file. In many locations, a video recording was made which was time stamped and allowed for location specific review at a later date. A total of 65 unedited videos were recorded and are provided as part of the ancillary data.

The final photomosaics were received December 15, 2016, from Kappa Mapping. These were added to a GIS along with field information and other data layers to aid in photointerpretation. Eelgrass beds were first outlined and screen digitized using the GIS software package, QGIS, and saved to a ESRI shape file. Digitizing was generally done at a screen scale of 1:1000 or less. The projection used was New Hampshire State Plane, NAD83, and the units were feet.

During the initial digitizing process, areas with a coverage of less than 10% and greater than 0% were included. After beds were outlined to form polygons, areas with less than 10% eelgrass coverage as visible from the aerial photography were deleted from the GIS file leaving the polygons of 10 percent cover or greater. Shapefile attributes included “id”, “Hectares”, “Acres”, and “Year” and an attribute “100 m2?” which was used to separate out polygons less that 100 square meters from the final results. These were maintained in the final file since the were locations that were clearly eelgrass but fell below the minimum mapping unit. They were not reported in the summary table and can be deleted if desired. The attribute, “id”, is a unique consecutive number; “Hectares” is the area of the polygon in hectares; “Acres” is the area of the polygon in acres; and “Year” is equal to 2016, the year of the aerial photography.

During the digitizing process and when the final file was produced, the topology of the shapefile was checked using the QGIS topology routine. The topology rules enforced included no gaps, no duplicates, no overlap, no invalid geometry, or no multi-part geometry.

Results and Discussion

No eelgrass was observed in Little Bay and Spinney Creek and very little was observed in the Piscataqua River above Seavey Island. In Great Bay, many of the beds were a mixture of macroalgae and eelgrass, particularly on the eastern side of the bay. The distribution of eelgrass for 2016 is shown in Figure 2.

The total area of eelgrass mapped in the entire project area was 1688.71 acres. This has been broken down by Assessment Zone and shown in Table 1. As in past years, Great Bay had by far the greatest amount of eelgrass, 1489.90 acres. The Portsmouth Harbor zone had 87.24 acres. The Little River and Back Channel zone had 39.08 acres. The Gerrish Island

area had 60.65 acres with additional area for these beds reported in both the Atlantic Coast and Portsmouth Harbor Assessment Zone. No eelgrass was found in the upper Piscataqua River, rivers feeding the estuary, or in Little Bay.

During the field visit on September 8, a close look was taken of the presence and distribution of macroalgae. In addition to the field observations collected using the drop camera, two divers with masks and snorkels, made observations and collected samples. These observations and later observations made with the drop camera were used to determine the presence and possible confounding of the signature. Unfortunately the GPS malfunctioned on that first day out and all data was lost. The locations were well enough defined and an additional GPS unit was used to navigate to each location so the field observations could be put in the proper geographic context.

It is felt that areas of dense eelgrass that contained macroalgae could be adequately differentiated from macroalgae. Locations where eelgrass was not dense (10-30% for example) were more difficult to differentiate and required field verification. In many locations macroalgae was found growing in dense concentrations around the stems of eelgrass plants. In this situation, dense eelgrass was clearly visible in the aerial photography but the macroalgae was much less evident or not detected. More work needs to be done to arrive at a reliable method to map macroalgae distribution, particularly when it is found in close association with eelgrass.

Oysters provided another signature that was clearly detected in some locations. If a large number of oysters were present on the surface of a mud bottom, the signature was distinctive. If found in the presence of eelgrass but not macroalgae, the eelgrass signature was clear and to a lesser extend, oysters could be detected. However, if oysters were present along with macroalge and eelgrass, the signature was confounded to the extend that only the predominate feature could be discerned. The hard bottom and different types of macroalgae also produced signatures that were difficult to separate from that of eelgrass and required field verification.

Figure 1. Field stations and GPS track logs.

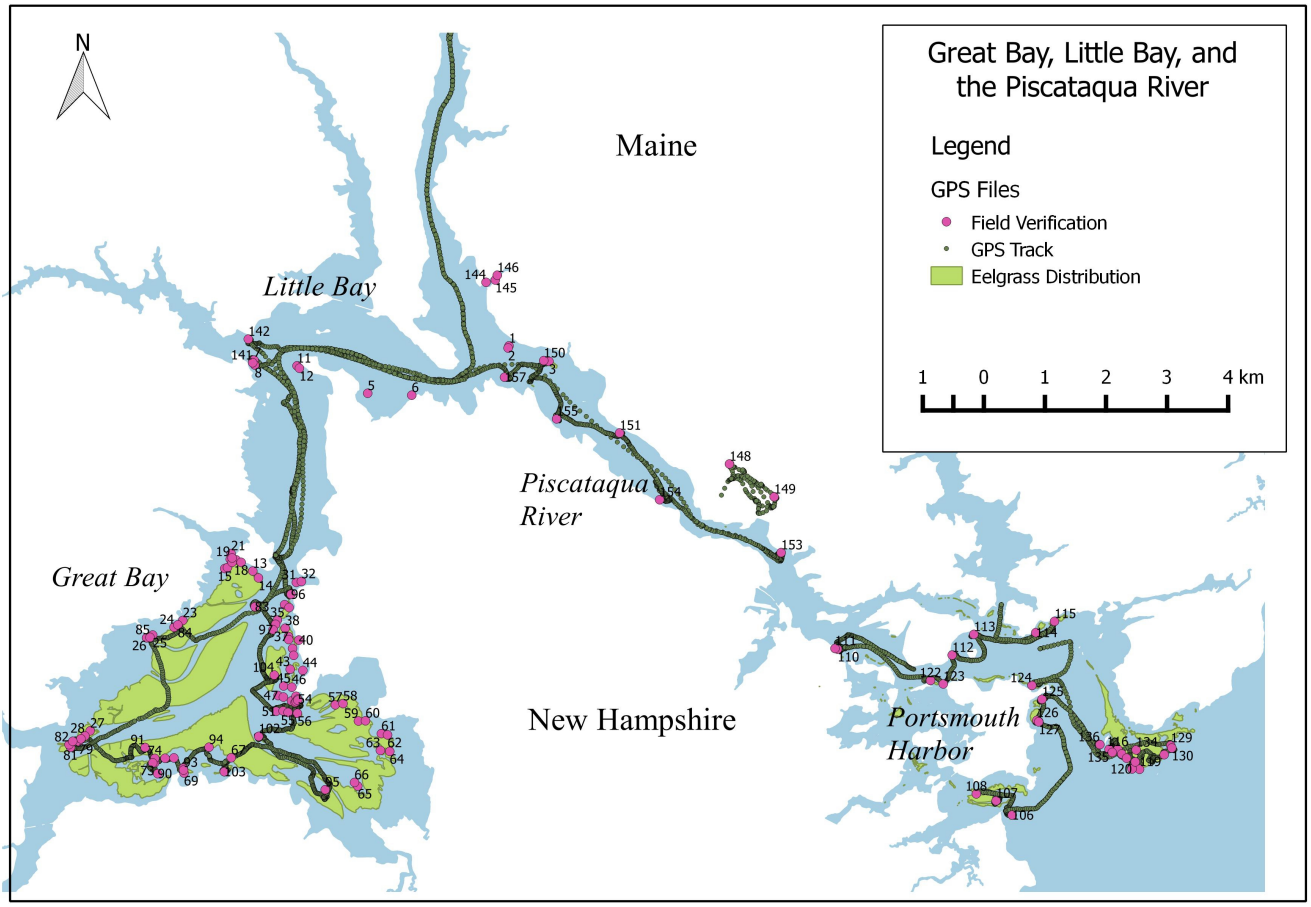


Figure 2. Distribution of Eelgrass, 2016.

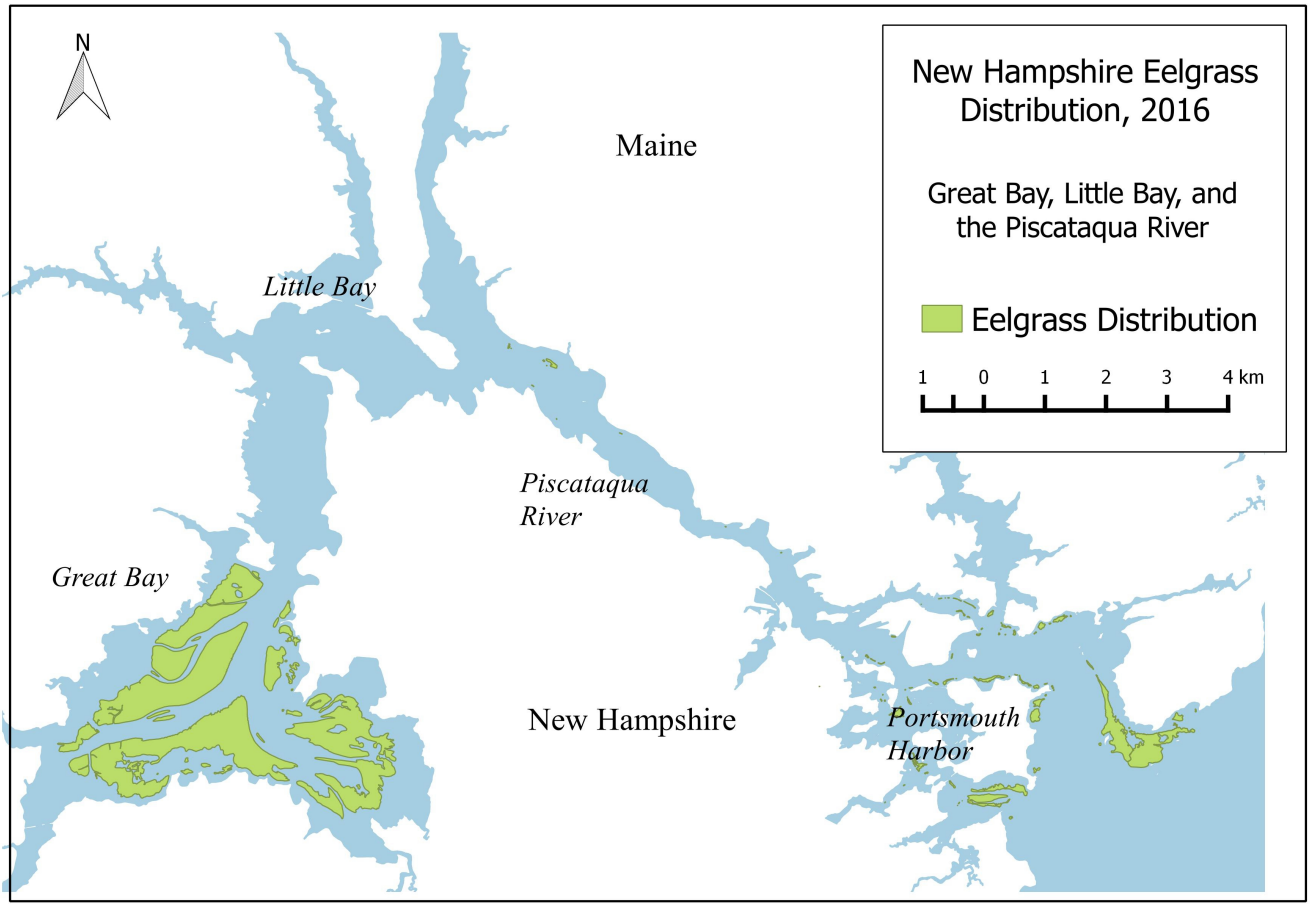


Table 1. New Hampshire Eelgrass Distribution – 2016	
Assessment Zone	**Area (Acres)**
Atlantic Coast	2.73
Gerrish Island Beds	60.65
Great Bay	1489.90
Little Harbor/Back Channel	39.08
Lower Piscataqua River North	2.92
Lower Piscataqua River South	3.58
Odiorne Point Beds	0.81
Portsmouth Harbor	87.24
Sagamore Creek	1.80
Total Result	1688.71

Appendix

A.1 Description of study area.

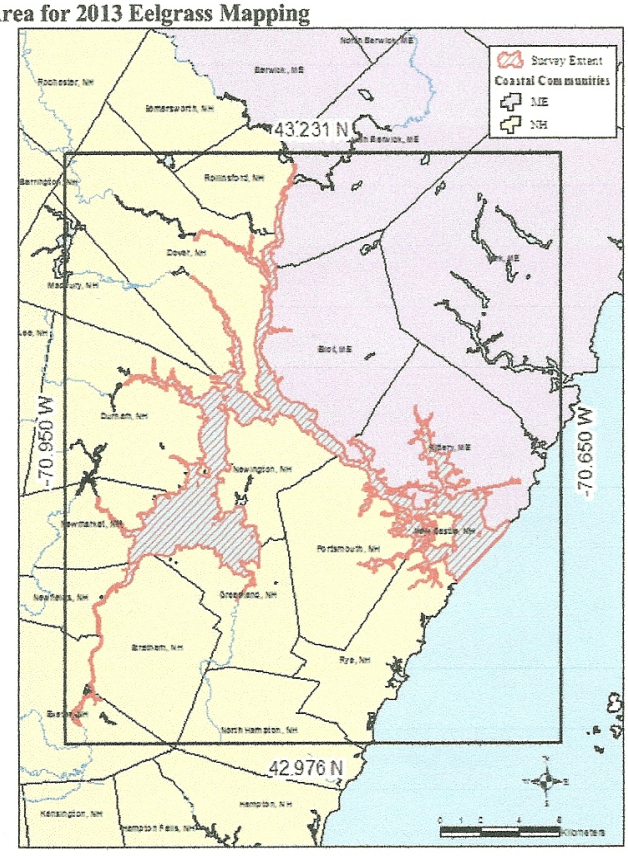
The assessment zone in 2016 was the same as that of 2013. The description from the 2013 QAPP is as follows:

A5 – Problem Definition/Background

Eelgrass (*Zostera marina*) is essential to estuarine ecology because it filters nutrients and suspended particles from water, stabilizes sediments, provides food for wintering waterfowl, and provides habitat for juvenile fish and shellfish, as well as being the basis of an important estuarine food web. Healthy eelgrass both depends on and contributes to good water quality. Therefore, PREP tracks the cover and density of eelgrass in the Great Bay Estuary as an indicator of estuarine health.

The objective of this project is to map eelgrass habitat in the Great Bay Estuary during the summer growing period of 2013. The Great Bay Estuary is 21 square miles of tidal waters located in southeastern New Hampshire. The area for eelgrass mapping extends from the head-of-tide of all tidal rivers and creeks to the mouth of Portsmouth Harbor. The mouth of Portsmouth Harbor is defined by lines extending from Odiorne Point in Rye, NH to White Island to Horn Island to Sewards Point on Gerrish Island in Kittery, ME. The total area to be mapped is approximately 22 square miles. The study area in which eelgrass will be mapped for this project is shown in Figure 2.

Figure 2: Study Area for 2013 Eelgrass Mapping



Appendix

A.2 Field sheet used for photointerpretation.

Station Number				Date (MMDDYY)	
Crew Chief				Crew Member 1	
Crew Member 2				Crew Member 3	
Purpose				GPS File	

Weather Condition				
Sea Condition				
Start Time			End Time	

Drop Camera Observation

Start Time	Observation	Depth	Offset	End Time	Notes

Eelgrass Presence
P - Present
A - Absent

Eelgrass Cover
1 Dense
2 Some Bottom
3 Half
4 Patchy
5 Sparse
6 None

Macro Algae
N – None
U – Ulva/Enteromorpha
G – Gracilaria
O – Other

Substrate
M – Mud
S – Sand
R – Rock
N – Not observed

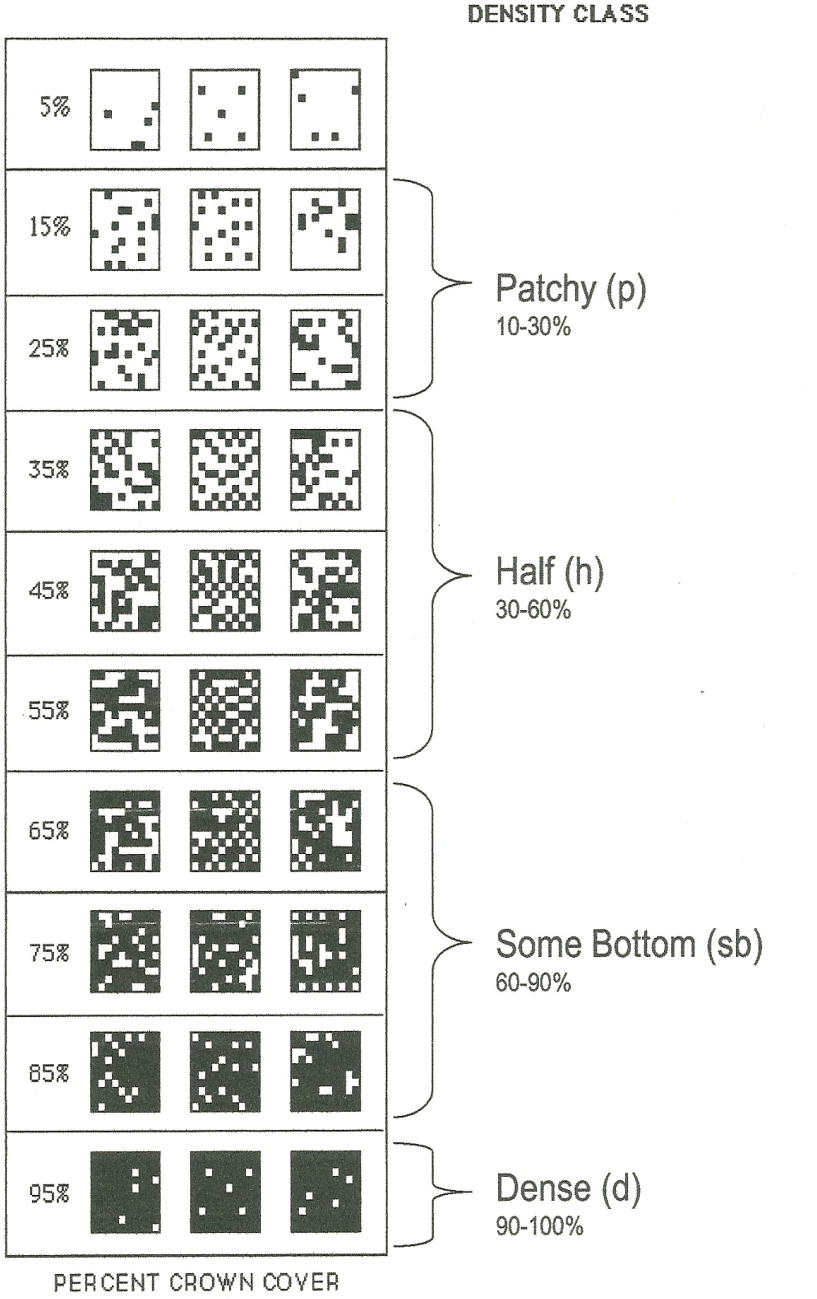
Appendix

A.3 Description of cover categories and photointerpretation aid (from QAPP).

Eelgrass cover greater that 10% as shown in the following density scale was mapped. Cover categories were not interpreted or coded.

Appendix F

Visual Guide for Eelgrass Percent Cover for Photointerpretation



Source: http://web.vims.edu/bio/sav/sav11/crown_density.html

A.4 1:24000 scale maps showing eelgrass beds in the Great Bay, Portsmouth Harbor, and the Piscataqua River area. Only locations with eelgrass are shown.

List of Maps:

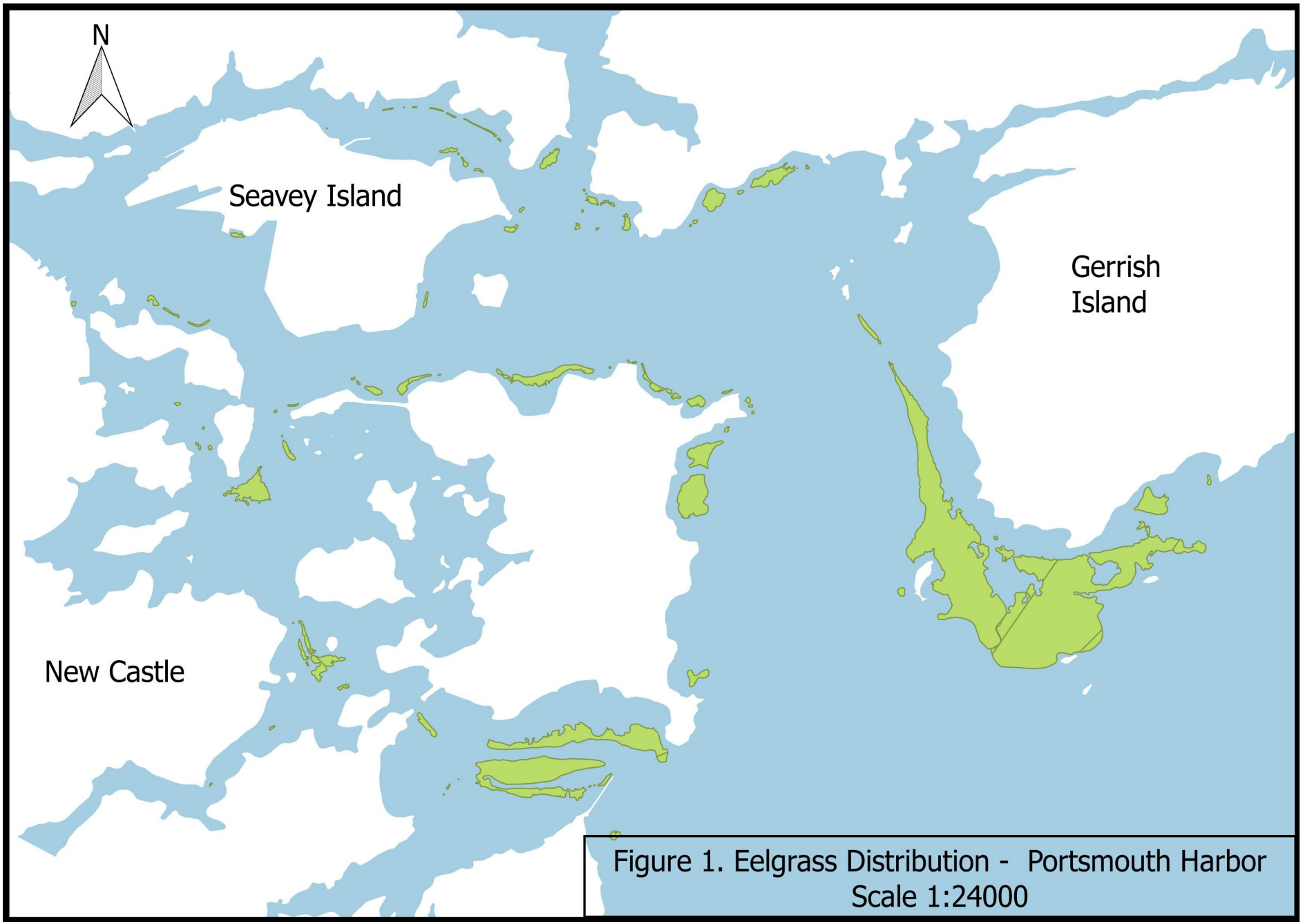


Figure 1. Eelgrass Distribution - Portsmouth Harbor
Scale 1:24000

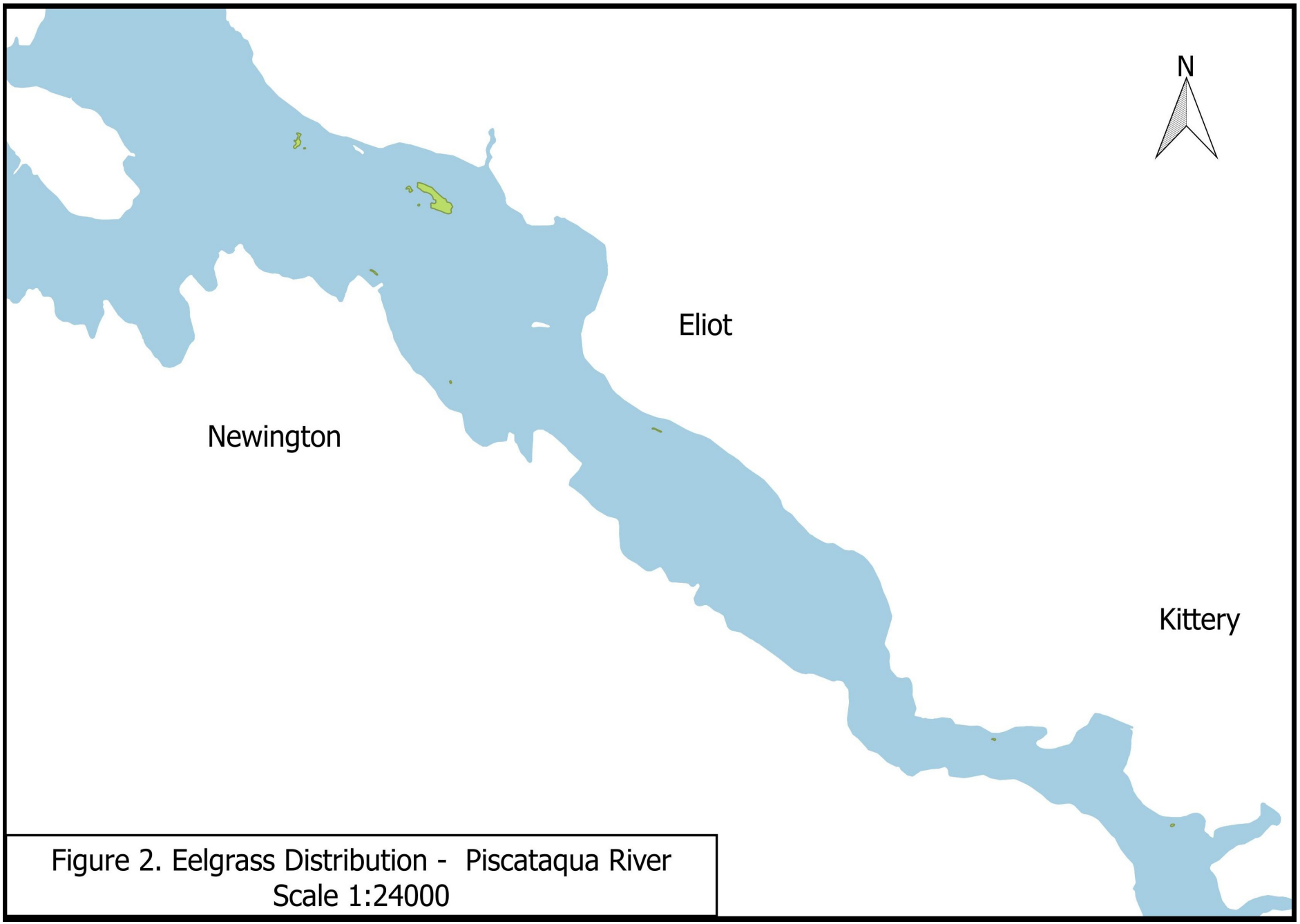


Figure 2. Eelgrass Distribution - Piscataqua River
Scale 1:24000

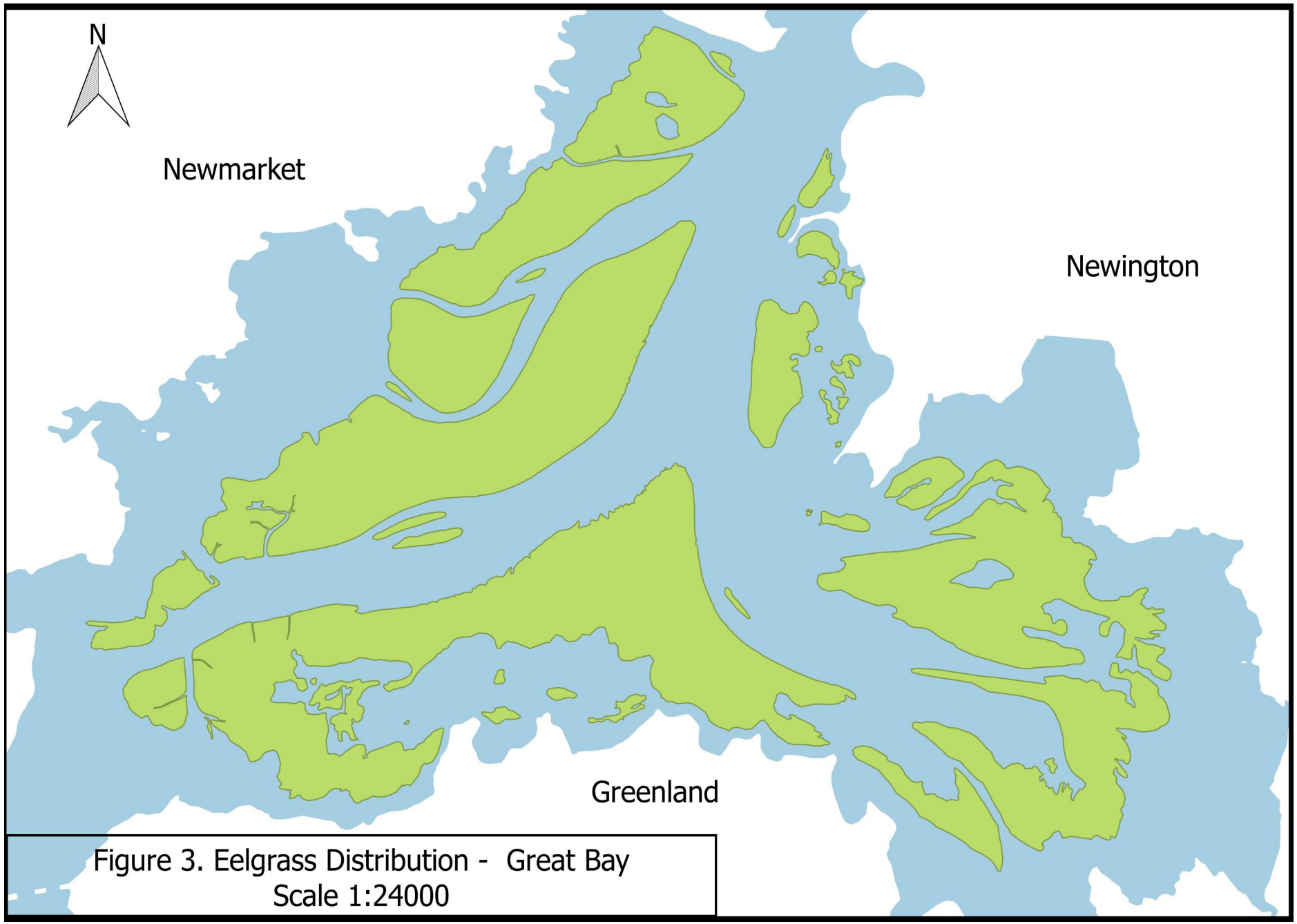


Figure 3. Eelgrass Distribution - Great Bay
Scale 1:24000